Edge Enhancement

Sidnei Paciornik Jun 21, 2013; 10:27pm **Edge Enhancement** Reply | Threaded | More

24 posts

Dear colleagues,

A simple need, but I could not find the right solution in ImageJ. I am sorry if it is obvious.

Is there a filter to increase edge sharpness and reduce the effect known as "halo effect" in optical microscopy?

At the edges of bright objects and a dark background (or vice-versa) there are normally pixels with intermediate pixel values. If other objects in the image have these pixel values, when they are segmented the edges of bright objects will also appear.

Even though these fake edges can be corrected by a morphological open, it is normally better to pre-process the image with an edge enhancement filter (some times called delineate) to increase the edge sharpness and reduce the amount of intermediate pixels.

Any hints?

Thank you!

Prof. Sidnei Paciornik
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ImageJ mailing list: http://imagej.nih.gov/ij/list.html

gankaku Jun 22, 2013; 3:23am **Re: Edge Enhancement** Reply | Threaded | More

43 posts

Hi Sidnei,

There is a plugin called Image Edges from Thomas Boudier (I think it is not included in Fiji by default but available on the following site: http://imagejdocu.tudor.lu/doku.php?id=plugin:filter:edge_detection:start).
Another possibility would be the "Edges" in FeatureJ from Eric Meijering which enables you to suppress "halo" effects. To my knowledge both plugins apply Canny edge detection based algorithms.

regards,
Jan

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ImageJ mailing list: http://imagej.nih.gov/ij/list.html

Sidnei Paciornik Reply | Threaded | More

24 posts

Hi Jan
I guess this is not quite the answer. I don't need edge detection, but
edge enhancement. I couldn't figure how either of your hints would do it.
The algorithm should be simple. Take a neighborhood, calculate min, max,
and range R.
Pick a threshold T.
If T>R it is not an edge, keep input pixel.
Else exchange pixel with max or min.

I just don't know how to program it.
Any other hints?
Thank you.
Em 22/06/2013 04:24, "Jan Brocher - BioVoxxel" <[hidden email]>
escreveu:

> Hi Sidnei,
>
> There is a plugin called Image Edges from Thomas Boudier (I think it is
> not included in Fiji by default but available on the following site:
> http://imagejdocu.tudor.lu/doku.php?id=plugin:filter:edge_detection:start
>).
> Another possibility would be the "Edges" in FeatureJ from Eric Meijering
> which enables you to suppress "halo" effects. To my knowledge both plugins
> apply Canny edge detection based algorithms.
... [show rest of quote]

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ImageJ mailing list: http://imagej.nih.gov/ij/list.html

gankaku Jun 23, 2013; 4:25am **Re: Edge Enhancement** Reply | Threaded | More

43 posts

Hi Sidnei,

I am not sure if this will be a solution you are looking for, but have you
considered unsharp masking (>Process > Filters > Unsharp Mask...).
Another possibility might be the "Contrast Detection from the BioVoxxel
Toolbox if you tick the option "enhance edges in original". This method
applied grayscale erosion and dilation to enhance edges and thereny might
lead to stronger edge enhancement than the unsharp mask but can also induce
artifacts if overdone.

kind regards,
Jan

2013/6/22 Sidnei Paciornik <[hidden email]>

> Hi Jan
> I guess this is not quite the answer. I don't need edge detection, but
> edge enhancement. I couldn't figure how either of your hints would do it.
> The algorithm should be simple. Take a neighborhood, calculate min, max,
> and range R.
> Pick a threshold T.
> If T>R it is not an edge, keep input pixel.
> Else exchange pixel with max or min.
>
... [show rest of quote]

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info: [hidden email]

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ImageJ mailing list: http://imagej.nih.gov/ij/list.html

Sidnei Paciornik Jun 23, 2013; 3:11pm **Re: Edge Enhancement** Reply | Threaded | More

24 posts

Hi Jan,

Thanks again for the hints, which I did test.

I guess the main drawaback is that these approaches tend to increase high frequency and contrast everywhere, not only at edges. They give me part of the improvemente I wanted, but also increasing noise within objects.

Let us see if some other colleague can add to the discussion.

Thank you!

Sidnei

On Sun, Jun 23, 2013 at 5:25 AM, BioVoxxel <[hidden email]> wrote:

> Hi Sidnei,
>
> I am not sure if this will be a solution you are looking for, but have you
> considered unsharp masking (>Process > Filters > Unsharp Mask...).
> Another possibility might be the "Contrast Detection from the BioVoxxel
> Toolbox if you tick the option "enhance edges in original". This method
> applied grayscale erosion and dilation to enhance edges and thereny might
> lead to stronger edge enhancement than the unsharp mask but can also induce
> artifacts if overdone.
... [show rest of quote]

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ImageJ mailing list: http://imagej.nih.gov/ij/list.html

BenTupper Jun 23, 2013; 7:11pm **Re: Edge Enhancement** Reply | Threaded | More

110 posts

Hi,

On Jun 23, 2013, at 3:11 PM, Sidnei Paciornik wrote:

> Hi Jan,
>
> Thanks again for the hints, which I did test.
>
> I guess the main drawaback is that these approaches tend to increase high
> frequency and contrast everywhere, not only at edges. They give me part of
> the improvemente I wanted, but also increasing noise within objects.
>
> Let us see if some other colleague can add to the discussion.

Can you post a small example in a public place so we can see what you are describing?

Thanks,
Ben

>
> Thank you!
>
> Sidnei
>

>
> On Sun, Jun 23, 2013 at 5:25 AM, BioVoxxel <[hidden email]> wrote:
>
... [show rest of quote]

--
ImageJ mailing list: http://imagej.nih.gov/ij/list.html

Sidnei Paciornik Jun 23, 2013; 10:14pm **Re: Edge Enhancement** Reply | Threaded | More

24 posts

Hi Ben

Here is a link to a pdf that explains the point.

https://dl.dropboxusercontent.com/u/20667937/Halo%20effect.pdf

Regards,

Sidnei

On Sun, Jun 23, 2013 at 8:11 PM, Ben Tupper <[hidden email]> wrote:

> Hi,
>
> On Jun 23, 2013, at 3:11 PM, Sidnei Paciornik wrote:
>
> > Hi Jan,
> >
> > Thanks again for the hints, which I did test.
> >
> > I guess the main drawaback is that these approaches tend to increase high
... [show rest of quote]

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ImageJ mailing list: http://imagej.nih.gov/ij/list.html

Gabriel Landini Jun 24, 2013; 5:27am **Re: Edge Enhancement** Reply | Threaded | More

1343 posts

On Monday 24 Jun 2013 03:14:08 Sidnei Paciornik wrote:
> Here is a link to a pdf that explains the point.
>
> https://dl.dropboxusercontent.com/u/20667937/Halo%20effect.pdf

I do not think this is a microscopy-only issue. Most digital images captured with a camera or scanner, if enlarged, will show some blurring around edges.

There is a similar approach called Morphological Contrast or Toggle Contrast, described in Soille's book Morphological Image analysis p. 259.
The procedure sets the pixel value to either Max or Min in a kernel, depending on which one is the closest to the original and so you do not need to rely on an arbitrary threshold. A macro to do this is in the Morphology zip file in my page (called Morphological_contrast.txt).
However to modify this to do what you want is trivial. You do the above if the difference of max-min is above a threshold t.
The original Morphological Contrast is the case when the threshold is 0.
Below is the macro modified to do this. Mind the line breaks.

Cheers
Gabriel

```
//---------------8<-----------------
// Morphological_contrast_Thr
// G. Landini 24/Jun/2013
// Sets the pixel value to either Max or Min, depending on which one is
// the closest  and above a set threshold
```

```
// Similar to Toggle Contrast in Soille, Morphological Image Analysis (2004),
// p. 259.
// It can use operators other than Min and Max (ie Open and Close, etc)

setBatchMode(true);
if (bitDepth()!=24){
 a=getTitle();
Dialog.create("Morphologica Contrast Thr");
Dialog.addNumber("Radius", 2);
Dialog.addNumber("Threshold", 25);
Dialog.show();
r=Dialog.getNumber();
t=Dialog.getNumber();

 run("Duplicate...", "title=min");
 run("Minimum...", "radius="+r);
 selectWindow(a);
 run("Duplicate...", "title=max");
 run("Maximum...", "radius="+r);

 selectWindow("max");
 w=getWidth();
 h=getHeight();
 i=0;
 max=newArray(w*h);
 for (x=0;x<w;x++){
  for (y=0;y<h;y++){
   max[i]=getPixel(x,y);
   i++;
  }
 }


 selectWindow("min");
 i=0;
 min=newArray(w*h);
 for (x=0;x<w;x++){
  for (y=0;y<h;y++){
   min[i]=getPixel(x,y);
   i++;
  }
 }

 selectWindow(a);
 i=0;
 for (x=0;x<w;x++){
  for (y=0;y<h;y++){
   c=getPixel(x,y);
   if (max[i]-min[i]>t){
     if((max[i]-c)<=(c-min[i])){
        putPixel(x,y, max[i]);
     }
     else if ((max[i]-c)>(c-min[i])){
       putPixel(x,y, min[i]);
     }
   }
   i++;
  }
 }
 updateDisplay();
 selectWindow("min");
 close();
 selectWindow("max");
 close();
}
else
 showMessage("Error","Greyscale images only!\nConvert RGB to HSB and
process\nthe Brightness channel only.");
```

setBatchMode(false);

//---------------8<----------------

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ImageJ mailing list: http://imagej.nih.gov/ij/list.html

Michael Schmid-3 Jun 24, 2013; 7:20am **Re: Edge Enhancement** Reply | Threaded | More

1269 posts

In reply to this post by Sidnei Paciornik

Hi Sidnei,

some edge-preserving blur operations can also sharpen edges. As an example, you could try the 'Thresholded Blur' filter:

http://imagejdocu.tudor.lu/doku.php?id=plugin:filter:thresholded_blur:start

Michael

On Jun 22, 2013, at 04:27, Sidnei Paciornik wrote:

> Dear colleagues,
>
> A simple need, but I could not find the right solution in ImageJ. I am
> sorry if it is obvious.
>
> Is there a filter to increase edge sharpness and reduce the effect known as
> "halo effect" in optical microscopy?
>
> At the edges of bright objects and a dark background (or vice-versa) there
... [show rest of quote]

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ImageJ mailing list: http://imagej.nih.gov/ij/list.html

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